

Integrins Regulate Repulsion-Mediated Dendritic Patterning of *Drosophila* Sensory Neurons by Restricting Dendrites in a 2D Space.

Journal: Neuron

Publication Year: 2012

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PubMed link: 22243747

Funding Grants: Training Program in Stem Cell Research at UCSF

Public Summary:

Dendrites are processes of nerve cells (or called neurons) that receive information from the environment or other neurons. During the development of nervous system, dendrites from the same neuron usually spread evenly in the receptive field and avoid crossing one other. Dendrites from neighboring similar kind of neurons also avoid overlapping through repulsive interactions between dendrites from neighboring neurons to ensure even but non-redundant coverage of the receptive field. This non-overlapping coverage of receptive field involves competition of dendrites for limited space. In fruit flies, the dendrites of one particular type of peripheral sensory neurons named class IV dendritic arborization (da) neurons cover the larval body wall in a non-overlapping manner. In this study, we discovered that dendrites of class IV da neurons grow mainly in a two-dimensional space on the extracellular matrix (ECM), a network of proteins that functions like glue to hold cells together into tissues, between epidermis and muscle. Depriving class IV da neurons of integrins, the protein that binds to ECM, or preventing epidermal cells from producing laminin, one major component of ECM, causes dendrites of class IV da neurons to grow into the epidermis. These results suggest that interaction between integrin-laminin ensure attachment of dendrites to the ECM. In addition, we found that in fly larvae mutant for genes that were previously shown to control even coverage of dendrites, class IV da neurons fail to limit the growth of their dendrites in a two-dimensional plane and often their dendrites often cross one another. However, increasing the expression of integrins in these mutants effectively reduces dendritic crossing and restores non-overlapping coverage of their dendrite fields. Therefore, our study provides novel insights into the mechanisms underlying non-overlapping dendritic coverage.

Scientific Abstract:

Dendrites of the same neuron usually avoid each other. Some neurons also repel similar neurons through dendrite-dendrite interaction to tile the receptive field. Nonoverlapping coverage based on such contact-dependent repulsion requires dendrites to compete for limited space. Here we show that *Drosophila* class IV dendritic arborization (da) neurons, which tile the larval body wall, grow their dendrites mainly in a 2D space on the extracellular matrix (ECM) secreted by the epidermis. Removing neuronal integrins or blocking epidermal laminin production causes dendrites to grow into the epidermis, suggesting that integrin-laminin interaction attaches dendrites to the ECM. We further show that some of the previously identified tiling mutants fail to confine dendrites in a 2D plane. Expansion of these mutant dendrites in three dimensions results in overlap of dendritic fields. Moreover, overexpression of integrins in these mutant neurons effectively reduces dendritic crossing and restores tiling, revealing an additional mechanism for tiling.

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